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(74) Agent: URQUHART-DYKES & LORD; Northern Assurance Buildings, Albert Square, Manchester M2 4DN (GB).			
(54) Title: MIXTURES OF MATERIALS SETTABLE ON EXPOSURE TO ATMOSPHERE			
(57) Abstract			
<p>A settable mixture comprises liquid polybutadiene, a flow-enhancing liquid, and particulate material. The mixture may be used as a substrate screed and/or filler for paving, wall and floor elements such as tiles, cobbles, concrete slabs. The mixture can be bagged in a substantially oxygen-free atmosphere ready for use.</p>			

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**MIXTURES OF MATERIALS SETTABLE ON EXPOSURE TO ATMOSPHERE**

**THIS INVENTION relates to mixtures of materials.**

According to this invention a settable mixture comprises polybutadiene, a flow-enhancing liquid, and particulate material.

The flow enhancing liquid may be a flow-enhancing solvent, and the polybutadiene is in liquid form.

The particulate material may for example comprise dry sand; ground or crushed glass, for example, including recycled glass and ground or crushed television tubes or fluorescent tubes which may include some non-glass material; ground slate or other mineral, for example, granite or stone.

The particulate material may be a mixture of different materials.

Two examples of flow-enhancing liquids are benzene (octane 140 to 165), and aliphatic hydrocarbons of the latter, examples are low aromatic, special boiling point 40/65 to 140/165; special boiling point 40/65 to 140/165 sold by Shell Chemicals U.K. Limited; D type aliphatic hydrocarbons; and BASF 125 sold by BASF.

The mixture is not adhesive, that is it is not tacky to the touch and can, for example, be placed on laid tiles and paving

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and swept into the gaps using a brush or the like or placed directly into the gaps between the tiles to act as a filler without sticking to the surface of the tiles.

The particles in the particulate material may be of uniform size or different sizes.

There may be additions, for example colourants and/or reinforcing material e.g. synthetic or carbon fibres.

A typical mixture, has by volume of the total mixture of polybutadiene, flow-enhancer and sand:-

2 to 4% polybutadiene ✓

0.1 to 0.4% benzene (octane 140 to 165) ✓

Balance % silica sand ✓

The mixture may be bagged so as to be contained in an essentially oxygen-free atmosphere.

The invention includes paving, flooring and wall elements secured or spaced apart by said mixture when set.

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The invention may be performed in various ways and some specific embodiments with possible modifications will now be described by way of example with reference to the accompanying drawing which shows a bag containing a mixture.

The invention provides a mixture which is settable on exposure to atmosphere (oxygen) and can be used indoors or outdoors for use as a screed or for pointing paving or flooring e.g. stones, cobbles, setts, tiles, concrete or clay or stone slabs; or for pointing wall tiles or bricks.

In general the mixture comprises polybutadiene, a flow-enhancing liquid and particulate material. The polybutadiene is in liquid form.

The flow-enhancing liquid may be a flow-enhancing solvent.

The particulate material which should be substantially dry, may, for example, comprise dry sand; ground or crushed glass, for example, including recycled glass and ground or crushed television tubes or fluorescent tubes which may include some non-glass material; ground slate or other mineral for example granite, stone.

The particulate material may be a mixture of different materials.

Examples of flow-enhancing liquids are benzene (octane)

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140 to 165), and aliphatic hydrocarbons. Examples are low aromatic special boiling point 40/65 to 140/165; special boiling point 40/65 to 140/165 sold by Shell Chemicals U.K. Limited; D type aliphatic hydrocarbons; and BASF 125 sold by BASF.

The mixture is not adhesive, that is it is not tacky to the touch and can, for example, be placed on laid tiles and paving and swept into the gaps using a brush or the like or placed directly into the gaps between the tiles to act as a filler without sticking to the surface of the tiles.

The glass particles in the particulate material may be of uniform size or different sizes.

The term dry sand includes sand which has been kiln dried and has then absorbed water from the atmosphere.

There may be additions to the mixture, for example a colourant and/or reinforcing material.

A particularly suitable form of liquid polybutadiene is that sold under the name Univest-S by Huls Aktiengessellschaft of Marl, Germany, and ideally occupies the mixture in an amount of between 1½% and 6% by volume.

A particularly preferred sand is kiln dried silica sand of special fraction size (which may have absorbed moisture from the

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atmosphere).

Examples of suitable mixtures are:-

1.	2% - 4%	By volume	Polybutadiene ✓
	0.1-0.4%	By volume	Aroma free Benzene (Octane 140-165) ✓
	Balance %	By volume	Kiln dried silica sand special fraction size ✓
2.	2% - 4%	By volume	Polybutadiene ✓
	0.1-0.4%	By volume	Aroma free benzene 140-165 ✓
	1% - 5%	By volume	Synthetic or carbon fibres ✓
	Balance %	By volume	Kiln dried silica sand special fraction size ✓
3.	2% - 4%	By volume	Polybutadiene
	0.1-0.4%	By volume	Aroma free Benzene 140-165
	0.1%-0.5%	By volume	Dry colour pigment
	Balance %		Kiln dried silica sand special fraction size
4.	2% - 4%	By volume	Polybutadiene
	0.1-0.4%	By volume	Aroma free Benzene (140-165)
	1% - 5%	By volume	Synthetic or carbon fibres
	0.1%-0.5%	By volume	Dry colour pigment ✓
	Balance %		Kiln dried silica sand special fraction size

The above examples contain sand as the particulate filler but other materials as referred to above may be used with or in place of the sand.

The mixing is done quickly and preferably by machine, to avoid or limit any setting which would occur due to heat and exposure to atmospheric oxygen.

After mixing, the mixture is placed in bags or other convenient containers, and vacuum packed to remove oxygen (air) and thus suspend the setting process in a substantially oxygen-free

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atmosphere until the bag is opened. The mixture may be contained in convenient amounts.

If required, to maintain flexibility in the bag, the extracted air may be replaced by a small volume of an inert gas such as carbon dioxide or nitrogen.

The mixture may be diluted if required, using, for example, vegetable oils.

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### CLAIMS

1. A settable mixture comprising polybutadiene, a flow-enhancing liquid, and particulate material.
2. A mixture as claimed in Claim 1, in which the particulate material comprises dry sand.
3. A mixture as claimed in Claim 1 or Claim 2, in which the particulate material comprises glass.
4. A mixture as claimed in any preceding claim, in which the particulate material comprises slate.
5. A mixture as claimed in any preceding claim, in which the flow-enhancing liquid comprises an aliphatic hydrocarbon.
6. A mixture as claimed in any of Claims 1 to 4, in which the flow-enhancing liquid comprises benzene.
7. A mixture as claimed in any preceding claim, in which the polybutadiene is in liquid form.
8. A mixture as claimed in any preceding claim, in which the polybutadiene is provided in an amount of between 1½% and 6% by volume of the mixture.
9. A mixture as claimed in any preceding claim, diluted

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with a vegetable oil.

10. A mixture as claimed in any preceding claim bagged in a substantially oxygen-free atmosphere.

11. A mixture as claimed in Claim 10, bagged in an inert gas atmosphere.

12. A mixture as claimed in any preceding claim and as described herein with reference to any of the Examples.

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# INTERNATIONAL SEARCH REPORT

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PCT/GB 97/03125

**A. CLASSIFICATION OF SUBJECT MATTER**  
 IPC 6 C04B26/04 // (C04B26/04, 14:06, 14:10, 14:22, 24:08, 24:36, 40:06)

According to International Patent Classification(IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)  
 IPC 6 C04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	EP 0 146 098 A (MARQUARDT GOTZ) 26 June 1985 see page 4, line 17 – page 5, line 16 see page 6, line 34 – page 7, line 9; claims 1,7,10,11,21 ---	1-10,12
Y	DE 40 35 359 C (V.GUELS) 16 April 1992 see column 3, line 40 – line 63 see column 5, line 39 – column 6, line 43 ---	1-10,12
A	EP 0 294 501 A (ELSNER WILFRIED ;STOCKI HORST (DE)) 14 December 1988 see column 1, line 37 – line 47; claims 1,5 ---	1,2,7,8
A	DE 41 01 032 A (MACK ANTON) 23 July 1992 see claims 1,5 ---	1,3 -/-

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

\* Special categories of cited documents :

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Date of the actual completion of the international search	Date of mailing of the international search report
9 March 1998	18/03/1998
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**C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT**

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>DATABASE WPI Section PQ, Week 8623 Derwent Publications Ltd., London, GB; Class Q31, AN 86-148990 XP002058244 &amp; SU 1 189 745 A (GRISHAEV I G) see abstract</p> <p>-----</p>	11

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